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# **The Channel Tunnel**

**-- A Case Study --**

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## ABSTRACT

### The Channel Tunnel - A Case Study

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The Channel Tunnel is the largest privately financed engineering project in history. Thirty-two miles in length, the tunnel stretches beneath the English Channel from England to France. When it becomes operational in December 1993, the Tunnel will be a crucial link in the emerging European high-speed rail system. However, the Channel Tunnel project itself has beset since its inception by financial and technical woes, blown schedules, and highly public battles between the Anglo-French company managing the project - Eurotunnel - and its contractors.

This case study describes the history of the Channel Tunnel project; from the earliest proposals for a fixed link across the Channel in the early 1800s, to the genesis of the current project. The paper examines the political pressures in Britain and France that impacted the project and some of the major provisions of the Channel Tunnel Treaty which govern it. The paper describes the major competing proposals for the fixed link, the ultimate selection of the Eurotunnel Company to build and operate the Tunnel, the financing arrangements and engineering design of the project, and the technical and financial difficulties that ensued.

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## INTRODUCTION

The Channel Tunnel - or the Chunnel, as it is also known - is the largest privately financed engineering project in history. (21:35) Thirty-two miles in length, it stretches from Cheriton, Kent in England to the town of Sangatte in the Nord Pas-de-Calais region of France (Figure 1). At each terminal, it is connected to both national highway and rail systems. When operational, the Tunnel will allow rail passengers to zip between London and Paris in 3 1/2 hours, compared to the 12 hours it now takes by rail and ferry. (23:A12) The Tunnel will be a crucial link in the emerging high-speed rail system that will give Europe the finest transport network in the world. A dramatic example of shrinking European frontiers, the Tunnel symbolizes the on-going economic integration of Europe.

The Channel Tunnel is actually three tunnels. There are two main rail tunnels; Northbound and Southbound, between which is a smaller diameter service tunnel (Figure 2). Cross passages connect the main tunnels to the service tunnel, allowing access for maintenance, evacuation of passengers, and supply of fresh air. It has been said that while politics have been unfriendly to the Tunnel and finances agonizing, geology has been kind. (22:16) Most of the Tunnel bores through a 160 million year old layer of impermeable chalk marl that runs in a continuous band all the way from Britain to France. (17:101) This marl is soft enough to scratch with a fingernail but holds together while the tunnel

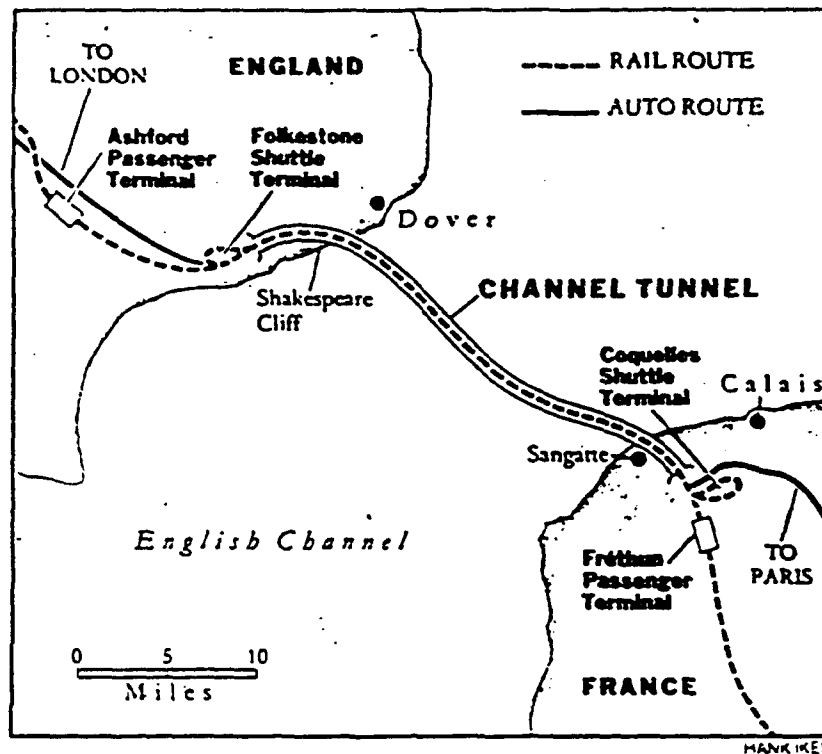


Figure 1  
(21:36)

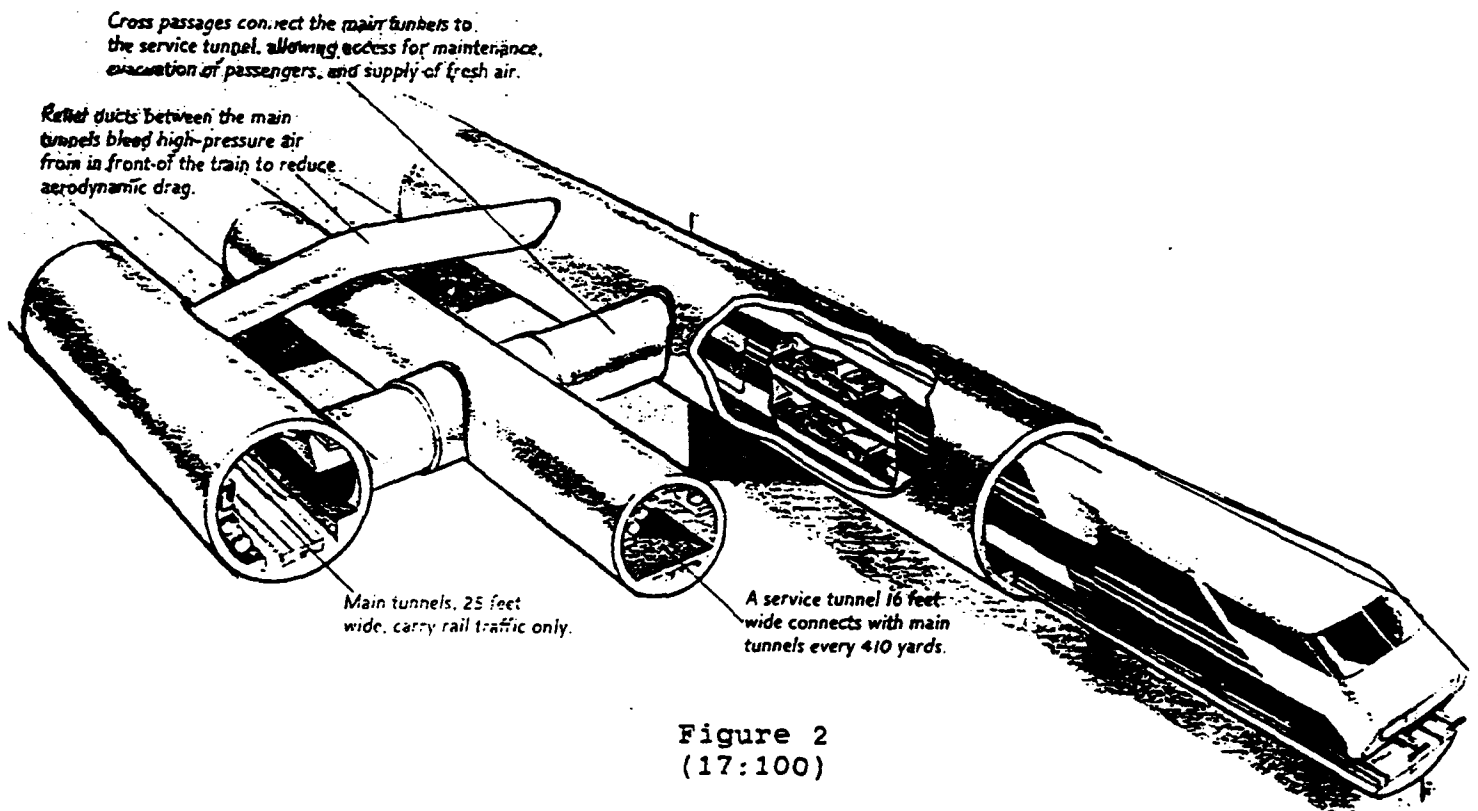


Figure 2  
(17:100)

linings are pressed into place - an ideal medium. With 23.6 miles of its 32 mile length under water, the Channel Tunnel is the second longest undersea tunnel ever built. The honor for longest tunnel goes to the Japanese, whose Seikan tunnel between the islands of Hokkaido and Honshu is 33.6 miles long. (5:42)

Today, excavation of all three tunnels is complete. Still remaining to be done is the laying of track and the installation of power, signals, and other facilities. However, the opening of the Channel Tunnel, originally scheduled for May 1993, has been officially postponed to December 1993 and indications are that the schedule may slip even further. (45:D3) The project has in fact been beset since its inception in 1986 by financial and technical woes, blown schedules, and highly public battles between the Anglo-French company managing the project - Eurotunnel - and its contractors.

### HISTORY

The story of this project goes back much further than 1986. One could say the "concept evaluation" stage of the Chunnel began in the early 1800s. One of the earliest proposals for a tunnel linking France and England was presented by a French mining engineer named Albert Mathieu to Napoleon in 1802. He proposed the idea of twin tunnels for stagecoach travel, to be ventilated by chimneys rising above the surface of the water. (21:77) Mathieu's proposal, never acted upon by Napoleon, is nevertheless



held to be the first in a long line of technically feasible (if not fully specified) schemes for an underwater tunnel. The present Eurotunnel project is said to be twenty-seventh in this line. (31:3)

In the 1880s, tunneling actually began from the British and French coasts. They had dug 2,000 yards out when the prospect of a tunnel became uncomfortably real for the British. Arguments that such a tunnel could provide an invasion route to England led to the cancellation of the project. Over the next century, studies were written, soundings taken, holes bored. What looked like a sure thing in the 1970s fizzled out in 1975 when Harold Wilson's Labour government decided it could either afford a tunnel or the Concorde, but not both. (21:77) This cancellation took place after 10 years of study and 14 months of digging. (16:4) Finally, in 1984 the governments of Britain and France decided to try again. Having agreed to set some common safety and environmental standards and to guarantee the project against political risks such as war (6:21), Prime Minister Thatcher and President Mitterrand threw open the project to bidders. Two years later, a decision was made from among some ten major proposals and the Channel Tunnel project was born. Before discussing the management and financing of the project, it would be useful to step back for a moment and examine the political environment in France and Britain, out of which the Channel Tunnel emerged.

## CHUNNEL POLITICS

In 1955, Harold Macmillan, then British Minister of Defense, was asked to what extent strategical objections still prevented the construction of a road-rail tunnel under the Channel. Macmillan's response was "Scarcely at all." (31:5) There ended 75 years of official British opposition to a fixed link across the Channel on the grounds of national security. The fact is that the defense argument, never very plausible in the first place, served to obscure the fact that the very idea of a fixed link to the continent was troubling to many Britons. The English Channel had served for centuries as a protector against foreign aggression - and foreigners. Wrote one petitioner to Parliament, "I've put up with being attached to Wales, but the thought of being attached to the French is beyond belief." (21:73) This merely echoed Lord Palmerston's reaction in 1858 to the suggestion that Britain support the building of a tunnel: "What! You pretend to ask us to contribute to a work the object of which is to shorten a distance we find already too short?" (31:8)

Hence national identity and xenophobia had much to do with England's reluctance to build a fixed link across the Channel through the mid-1900s. Since then, opposition in Britain to a fixed link has come from a number of sources. In Kent, there was little enthusiasm for such a project. Inhabitants of this rural area feared the heavy traffic and ugly businesses that would spring up along roads to the tunnel. Ferry and port interests,

anticipating the loss of revenue and jobs due to tunnel competition, initially tried a vicious and xenophobic advertising campaign to prevent the government from giving the Chunnel project the go-ahead. However in recent years, cross-Channel traffic has increased so much that, even with a severely reduced share of the market, ferry companies now say that the Channel Tunnel is "a challenge we can live with." (39:10) Beyond Kent, a fixed link was viewed as a good thing by business in general, and by the construction industry in particular, which consistently lobbied the government in its behalf. In the end, the Thatcher government had much larger motives in supporting the project. A fixed link was seen as a symbol and a means to further integrate Britain into the expanding economy of the European Community. And in that era of British privatization, the Channel Tunnel project offered a highly visible means of proving the superior efficiency and effectiveness of the private sector over the public sector.

On the French side of the Channel, the political environment was quite different. Not only do the French have a long-standing tradition of supporting large infrastructure projects, the Tunnel itself meshes nicely with their already successful rapid train system, Train a Grande Vitesse (TGV). The French also viewed the project as a direct means to promote development in the economically depressed Nord Pas-de-Calais region. This area, long dependent on the declining coal, steel, and textile industries, had lost more than 130,000 jobs between 1975 and 1984. At 14 percent, its unemployment rate was well above the national

average. (21:73) The City of Calais, initially fearful of the possible loss of 5,000 port jobs, quickly turned around and began to aggressively plan for future development. The Coquelles terminal is planned to include a business park, conference and hotel center, and warehouse depot. In addition, the French government is pouring money into new roads and improved port facilities. Hotel capacity in and around Calais has doubled in the last two years (39:10) and it is estimated that inbound businesses may spur a doubling of the population by 1998. (21:73)

Nowhere is the difference in political will between France and Britain more pronounced than it is with regard to the construction of railroad track for high speed trains from the coast to their respective capitals. Whereas the French high speed trains will be up and running soon after the Tunnel opens, equivalent service in Britain may not be available until the end of century. Local opposition and British government refusal to commit public funding to build a high speed link means that trains will race along at 185 mph in France, slow to 80 mph in the tunnel, and crawl at 40 mph on the leg to London. (23:A12)

#### GENESIS OF THE CURRENT PROJECT

In this political context, we now turn to the genesis of the current project. In the early 1980s, interest in a fixed link across the Channel had again begun to surface. The Thatcher and Mitterand governments danced around each other for a few years

over the issue of private versus public financing. The British were fully committed to private funding, if not to the idea of the fixed link itself. The French, fully committed to a fixed link for almost every year of the previous century, were understandably suspicious of the British, remembering the 1975 cancellation (of which they had borne half the cost) and doubting the feasibility of private finance.

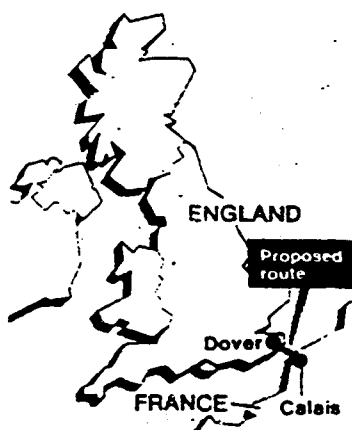
By 1984, however, the two governments had come to an agreement and jointly issued an Invitation to Promoters. The British had won the financing issue - the successful bidder would have to raise all financing from private sources without government aid or loan guarantees. Four basic rules were laid down for bidders: proposals had to be technically feasible, financially viable, Anglo-French, and accompanied by an Environmental Impact Assessment. (31:14) By October 1985, ten proposals had been tendered by various consortia. Of these, there were four serious contenders (Figure 3):

- (1) Channel Tunnel Group/France-Manche (later to become Eurotunnel): a double rail tunnel to accommodate both through-trains and special car-and-truck-carrying shuttle trains. Price: \$5.5 billion (6:37)
- (2) EuroRoute: a bridge/tunnel scheme. Road bridges would stretch out about 5 miles from the British and French coasts to artificial islands, which would be connected by a 13-mile

long submerged tube tunnel. A separate, bored, twin-track rail tunnel for through-trains, would be built later, in stages. Price: \$11.0-14.0 billion (6:37)

(3) Eurobridge: bridge scheme comprising a 21-mile motorway in an enclosed tube suspended in 3-mile spans from 900 foot towers; a rail link could be provided either on the bridge, or in a small-diameter tunnel. Price: \$11.5 billion (6:37)

(4) Channel Expressway: twin very large bored tunnels, containing a two-lane expressway for motor vehicles and a train track. Price: \$2.9 billion (6:37)



#### Four Contenders for Link Between Britain and France

Estimated cost, in billions of dollars

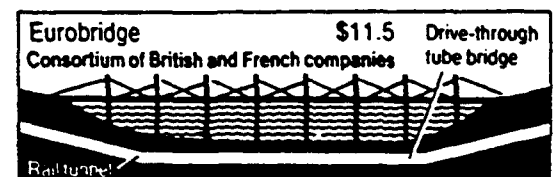
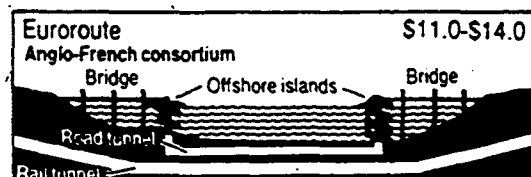
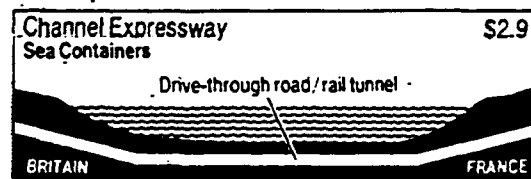


Figure 3

(6:37)

These proposals were evaluated over a two month period, at the end of which the Channel Tunnel Group/France Manche SA (CTG/FM) proposal was pronounced the winner. In many ways, the CTG/FM proposal was a compromise solution. However, it was relatively safe, in that it depended on proven technology, looked financially viable, and was a clear extension of projects had been positively appraised by official commissions in the 1960s and 1970s. (31:17)

### EUROTUNNEL

The winning bidder, CTG/FM, was a private consortium of 15 British and French construction companies and banks. It quickly reformed itself as two holding companies, Eurotunnel PLC and Eurotunnel SA, which were given the job of raising finance, and an umbrella holding company, the Eurotunnel Group. The company was led by two co-chairmen; Lord Pennock on the British side and André Bénard on the French.

To build the Tunnel, Eurotunnel contracted Transmanche Link (TML), thereby generating a proper client-contractor relationship at the heart of the project. TML is an Anglo-French joint venture between Translink in Britain, and GIE Transmanche Construction in France, these two groups in turn being joint ventures of the construction companies originally brought together in CTG/FM.

Britain and France signed a draft treaty in February 1987. After the successful passage of Channel Tunnel legislation in both

countries, the treaty was ratified in July. A concession agreement was signed with Eurotunnel which provided for a concessionary period of 55 years from the treaty date. At the end of that period, Eurotunnel must hand over the fixed link in full working order to the two states. Until that time however, Eurotunnel has the sole right to operate the Channel Tunnel. Because both governments support the eventual construction of a drive-through road tunnel, the agreement stipulates that unless Eurotunnel devises a drive-through option by 2010, the government may open such a project to competitors after 2020. (31:17)

The Channel Tunnel Treaty specifically states that "The Channel fixed link shall be financed without recourse to government funds or to guarantees of a financial or commercial nature." (31:30) In return, Britain and France are prohibited from regulating prices except in a situation of near- or actual monopoly. The agreement also provides for certain minimum standards of service during off-peak periods, and maximum delays in the busiest periods. Finally, the treaty and concession agreement establish an Intergovernmental Commission (IGC) to supervise fixed-link security, safety, and environmental impact, and to assume responsibility for it in exceptional circumstances.

#### **EUROTUNNEL FINANCING**

To finance the Tunnel, Eurotunnel sought both equity and loan capital, the latter being to some extent conditional on the



former. The initial equity interest of founder shareholders in Eurotunnel became known as Equity I. (31:19) In October 1986, Equity II, a private placement of £253 million in shares was arranged. This initial test of investor interest in Eurotunnel went smoothly in France but nearly failed in Britain. By February 1987, lackluster sales prompted several top management resignations from the British side of Eurotunnel. Lord Pennock was replaced by Alastair Morton, a merchant banker with a reputation as a strong but abrasive leader. The British shares were finally placed, but only after the Bank of England prodded major banks and corporations to buy them. (12:D4) In November 1987, hot on the heels of the October stock market crash, Equity III was launched. This was the main public share issue of £770 million. Difficulties were again experienced in Britain, but the issue was eventually fully underwritten. (31:19)

Loan finance, in the initial form of a syndicated loan of £5 billion, was raised through a consortium of 206 banks world-wide (of which few were British). An important clause in the 1987 loan agreement stipulated that the project had to be fully financed to completion. (20:51) This was to have significant impact later, as subsequent cost overruns made it necessary for Eurotunnel to increase both equity and loan capital beyond the combined £6 billion which had been raised by the end of 1987. A discussion of these financial difficulties follows in the next section.

Eurotunnel's operations and proposals are subject to considerable external control. The Intergovernmental Commission is the main oversight agency and under it are a number of subsidiary commissions, such as the Safety Authority. The bank syndicate also appointed technical watchdogs. In fact, in spite of the large amount of regulatory machinery that has been built around the Tunnel, real economic control is in the hands of the banking syndicate. It is the banks which control finance at each stage, by monitoring construction before allowing Eurotunnel to draw on its agreed lines of finance. (31:154)

#### TUNNEL OPERATION

As mentioned earlier, Eurotunnel will be the sole operator of the Tunnel until 2042. Three types of trains will use the Tunnel.

- Shuttle trains, owned and operated by Eurotunnel, will carry trucks and cars through the tunnel, making the trip between Folkestone and Coquelles in 35 minutes and exiting directly onto local highways. Roughly 60 percent of Eurotunnel's revenues will come from this shuttle service, recently christened "Le Shuttle." (41:72)
- Passenger trains owned by British Rail and the national railway of France, Société Nationale des Chemins de Fer Française (SNCF), will speed between London, Paris, and Brussels.

- Long container trains, again owned by the railways, will carry bulk freight between centers in Britain and main Europe.

Payments by British Rail and SNCF for the passengers and freight carried through the tunnel (during the intervals between Le Shuttle crossings) will provide the other 40 percent of Eurotunnel's revenues. (41:72) Freight and passenger trains using the Channel Tunnel will stop at Fréthun on the French side and Ashford on the British side en route to more distant points (Figure 1).

As a side note, incompatibility problems between the British and continental railway systems made it necessary for British Rail and SNCF to order special, Chunnel versions of the French high speed train to operate between London, Paris, and Brussels. Continental rolling stock is wider and higher than that of British Rail, which would have led to problems with platforms and bridges. In addition, Britain's electric trains run on different voltages. (24:66) Consequently, the new trains will run on three voltages, picked up two different ways, and react to three different signalling systems. These incompatibility problems have shelved prospects of through-trains running straight from France to British provincial cities, and of night sleepers to southern Europe. (24:66)

It is expected that 10 million passengers and 16 million tons of freight will pass through the Tunnel in its first year.

Eurotunnel estimates that by the year 2003, those numbers will rise to 44 million passengers and 27 million tons of freight (40:10).

### EARLY FINANCIAL DIFFICULTIES

Initially, 15 May 1993 was set as the Tunnel's opening date, but early construction delays - or as TML maintains, delays in starting the project up - caused this to be put back by a month to 15 June 1993. Meanwhile real construction cost estimates rose (in 1985 prices throughout) from around £2.3 billion in the 1985 submission, to £2.7 billion at the time of the Equity III prospectus in November 1987, to nearly £3 billion a year later. At the end of 1989, they were estimated by Eurotunnel at £4 billion, by TML at £4.2 billion, and by the banks' technical adviser at a possible £4.6 billion. Total financing costs, including allowance for inflation, had been estimated at around £4.8 billion in 1987, at £5.4 billion in 1988, and were thought by the end of 1989 to be anything between £7.5 and £8 billion.

What was at the root of these cost increases? Large construction projects in general are notorious for cost and schedule overruns and the Channel Tunnel is no exception. Four major factors are discussed below. (31:52,53)

First, in spite of the fact that government agencies on both sides of the Channel had been examining fixed link schemes for decades, when the decision was made in 1984 to open the project to bidders, very little time was allowed for detailed design studies in advance of construction. The schedule called for the Tunnel to be open for operation in May 1993. This meant that the project was to move from design consideration to completion in a mere 7 1/2 years. As a result, a number of design problems were not identified at the start of the project and no provisions were made for them in Eurotunnel's initial cost estimates. This problem was at the heart of the dispute over costs between Eurotunnel and TML at the end of 1989. TML argued that the cost increases were chiefly due to deficiencies in the initial design and cost estimates. Eurotunnel maintained they were due to TML inefficiencies in following a perfectly satisfactory design. The independent monitor appointed to assess those early claims found largely in favor of Eurotunnel, but the disputes continue to this day.

A further complication arose from public surveillance of the project through the Intergovernmental Commission. Eurotunnel and TML are required to submit designs to the IGC for authorization. The original concession agreement contained merely a general outline of the plan. The additional submissions fill in the details. The IGC can reject any design on grounds of safety, security, environmental acceptability, and so on. In practice, under the pressure of time, the IGC has received a number of

design drafts during construction. This led to a series of piecemeal approvals on some elements of the project, which made ultimate rejection more difficult. (31:153).

Second, the original promoters (CTG/FM) of the Channel Tunnel project were construction companies and banks which sought their main return from construction of the Tunnel, rather from its operation. Although Eurotunnel acted quickly to distance itself from this core group of founder shareholders, it nevertheless let a single contract for the design and construction of the Tunnel to its founder shareholders in the new guise of TML. The young Eurotunnel was at a distinct disadvantage in negotiating with these experienced contractors. A better approach might have been for Eurotunnel to let a series of contracts for separate sections of the work.

A third source of cost escalation for the Tunnel is one that is common to nearly all acquisitions. That is the competitive pressure that prompts bidders to cut their cost estimates to the bone in order to make a successful bid. Knowing that they were to be judged on financial viability, the competing consortia tended to minimize their margins. Later on, the cost increases were blamed on delays from the parliamentary process which authorized the project and the early financing difficulties.

Fourth, an imbalance in the client-contractor relationship is generated by the fact that there comes a point in any large

construction project when the cost of schedule overruns (in the form of lost revenues) is more damaging than direct cost increases. In other words, since Eurotunnel cannot earn a cent on its investment until the Tunnel is operational, it is apt to find schedule delays more damaging than cost overruns. This put a real weapon in the hands of the contractors.

### CRISIS POINT

The covenant in the 1987 loan agreement stipulating that the project be fully financed had been broken since July 1989. The banks had been waiving the clause to allow digging to continue, but in January 1990, a crisis point was reached. By suggesting that even TML's latest figure of £8 billion for cost to completion was too low, the bank's independent technical adviser put the entire project in doubt. In order to restore the bank syndicate's confidence, Eurotunnel was forced to revise its contract with TML and seek additional equity and loan capital. As part of the revised contractual agreement, Alastair Morton (who had been riding TML hard on costs) was demoted to chief executive under André Bénard, who became sole chairman.

In the revised agreement, the total construction cost was put at £4.2 billion, and total financing cost to completion at £7.6 billion. To maintain the desired funding margin, Eurotunnel was required to raise an extra £2.7 billion in capital, of which £2.1 billion would come from loans, and the remainder from a new equity

issue. The refinancing operation was concluded in December 1990.  
(31:21)

Agreement had been reached between Eurotunnel and TML on most, but not all, cost disputes (some elements were referred to arbitration). The new agreement not only greatly exceeded what had previously been thought a maximum financing limit, it was based on a lower Tunnel specification. Eurotunnel had to accept lower speeds through the tunnel for trains and shuttles, open rather than closed truck-shuttles, a less glamorous Tunnel portal on the French side, and so on. (31:54)

However by the end of 1990, a tunnel at last linked Britain and France. A pilot tunnel, only inches wide at its narrowest point, had broken through in October; the two ends just 18 inches out after boring blind for 24 miles. (22:16) On 1 December, tunnelers successfully broke through in the service tunnel. The project at the end of 1990 looked both financially and technically assured. This happy state of affairs did not last long.

#### **MORE CHUNNEL TROUBLE**

During 1991, the tunneling operation moved along smoothly. The Northbound main tunnel was linked in May and the Southbound tunnel in June, three months ahead of schedule. However, contractors



checking the aerodynamics of the tunnel had discovered that it would require air-conditioning: a big surprise for the tunnel designers. Rail tunnels in general do not require air-conditioning because air can usually circulate freely from one end of the passage to the other. Not so in the case of the 32-mile long Chunnel. The heat that the high-speed trains will generate as they pass through the long, narrow tunnels is expected to cause temperatures as high as 130 degrees Fahrenheit. As a result, Eurotunnel is now buying what has been described as the world's most expensive air-cooling system. The \$200 million system consists of pipes, running the length of the main tunnels, through which chilled water flows from gigantic refrigeration units located at each end of the Tunnel (25:D9).

Negotiations between Eurotunnel and Transmanche Link over some £1.2 billion in new construction and equipment cost overruns became increasingly heated over the year, erupting in early 1992 with the announcement that the opening of the Tunnel was to be delayed three to four months beyond the original target date. In March 1992, an independent arbitration panel ruled that Eurotunnel had to begin paying £50 million per month toward the disputed £1.2 billion claim. Eurotunnel appealed the ruling to the International Chamber of Commerce (ICC) in Brussels, but was instructed by the banking syndicate to make the payments pending outcome of ICC arbitration. (35:2) Eurotunnel was again in breach of its loan covenant (due to the rising costs and late opening) and the Disputes Panel's ruling clearly worsened the situation. In

order to continue drawing on its line of credit to pay for construction, Eurotunnel again needed a waiver from the banking syndicate.

By September 1992, more troubles emerged. The company making the special, Chunnel versions of the French high-speed train for British Rail and SNCF announced that they would be a year late in delivery. Therefore Chunnel expresses will not be operating until summer 1994. Le Shuttle, too, was running into problems. Once promised for June 1993, the cavernous wagons that are to carry cars and trucks through the Tunnel and the special engines required to pull them are both six months behind in delivery. Furthermore, Eurotunnel had cause for alarm with regard to its freight business. The privatization of British Rail and subsequent collapse of Charterail, a private rail-freight company that rented trains from British Rail, showed how hard it will be for rail freight to compete with road haulage without subsidy.

The banks continued to grant waivers and extensions to Eurotunnel throughout the year. However in October 1992, amidst rumors of bankruptcy and new rights issues, Eurotunnel again pushed back the expected opening date - this time to 15 December 1993.

## CONCLUSION

At the end of 1992, Eurotunnel and Transmanche Link were still embroiled in negotiations over who should pay for increased Tunnel

costs. The Tunnel is still due to open in mid-December 1993, six months behind its original schedule, but Eurotunnel has hinted that a further delay may be announced. However, in spite of all of their difficulties, Eurotunnel and TML have scored an engineering triumph in getting the Tunnel built. The next, and perhaps greatest, hurdle that Eurotunnel must face is earning enough revenue from traffic through the Tunnel to service its vast debts before its banks lose patience. The long-term outlook for Eurotunnel looks good. Salomon Brothers has estimated the long-term yield on Eurotunnel shares at 15 percent. However, with delays in the delivery of trains and shuttles, worries about the viability of the rail freight business, and a recession to contend with, the question remains: who will own most of Eurotunnel's shares at the turn of the century. Today's shareholders? Or the banks?

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## APPENDIX

### SEMINAR LEADER GUIDE

#### Case Study - The Channel Tunnel

Seminar leaders may wish to prompt discussion through the v of the following questions.

1. Both Britain and France initially experienced political and special interest opposition to the project. What were the requirements of political consensus building in getting the project started? What were the differences/similarities between the English and French positions concerning its viability?
2. The issue of public versus private funding was a source of significant governmental maneuvering between the Thatcher and Mitterand administrations. Discuss the impact of the ultimate decision in favor of private financing on the oversight process, external controls, schedule overruns, and cost growth.
3. One of the initial requirements to perspective bidders was that the proposal be technically feasible. Discuss the technical challenges prior to construction. What impact did any unforeseen requirements (air conditioning, rail/train compatibility, etc.) place on cost and schedule overruns? Could they have been anticipated?
4. From 1985 to 1989, total cost projections rose over 300% from £2.3 billion to nearly £8 billion. Four major root causes were noted in the case study. Discuss and elaborate on them.
5. Discuss the implications of the completed Chunnel on the European Economic Community (EC) transition which is set to occur within the next decade. How will it contribute to or detract from the already prevalent feelings of uncertainty?
6. What parallels can be observed between the Chunnel project and defense contracting as we know it? (See below.)

#### PARALLELS TO DEFENSE CONTRACTING

IMPACT OF POLITICS: Local opposition and British government refusal to commit public funding to build a high speed link means that trains will race along at 185 mph in France, slow to 80 mph in the tunnel, and crawl at 40 mph on the leg to London.  
(p. 7)

**SOURCE SELECTION CRITERIA:** Four basic rules were laid down for bidders: proposals had to be technically feasible, financially viable, Anglo-French, and accompanied by an Environmental Impact Assessment. (p. 8)

**SOLE SOURCE CONTRACTING, CONTRACTORS AS PROMOTERS:** The original promoters (CTG/FM) of the Channel Tunnel project were construction companies and banks which sought their main return from construction of the Tunnel, rather from its operation. Although Eurotunnel acted quickly to distance itself from this core group of founder shareholders, it nevertheless let a single contract for the design and construction of the Tunnel to its founder shareholders in the new guise of TML. The young Eurotunnel was at a distinct disadvantage in negotiating with these experienced contractors. (p. 17)

**LOW-BALLING:** Competitive pressure prompts bidders to cut their cost estimates to the bone in order to make a successful bid. Knowing that they were to be judged on financial viability, the competing consortia tended to minimize their margins. Later on, the cost increases were blamed on delays from the parliamentary process which authorized the project and the early financing difficulties. (p. 17)

**COMPROMISE SOLUTION, PROVEN TECHNOLOGY:** The CTG/FM proposal was a compromise solution. However, it was relatively safe, in that it depended on proven technology, looked financially viable, and was a clear extension of earlier projects. (p. 10)

**OVERSIGHT:** The treaty and concession agreement established an Intergovernmental Commission (IGC) to supervise fixed-link security, safety, and environmental impact, and to assume responsibility for it in exceptional circumstances. (p. 11) The bank syndicate also appointed technical watchdogs. In fact, in spite of the large amount of regulatory machinery built around the Tunnel, real economic control is in the hands of the banking syndicate. It is the banks which control finance at each stage, by monitoring construction before allowing Eurotunnel to draw on its agreed lines of finance. (p. 13)

**FULL FINANCING:** An important clause in the 1987 loan agreement stipulated that the project had to be fully financed to completion. This was to have significant impact later, as subsequent cost overruns made it necessary for Eurotunnel to increase both equity and loan capital beyond the combined £6 billion which had been raised by the end of 1987. (p. 12)

**INADEQUATE DEM/VAL STAGE:** The deepest flaw of the project was its rushed and inadequate planning. This, more than any other



unknown, allowed the price to spiral as ad hoc modifications led to bitter rows between ET and the contractors. Very little time had been allowed for detailed design studies in advance of construction. The schedule called for the project to move from design consideration to completion in a mere 7 1/2 years. As a result, a number of design problems were not identified at the start of the project and no provisions were made for them in Eurotunnel's initial cost estimates. (p. 16)

**TECHNICAL RISK (UNKNOWN UNKNOWNNS):** Contractors checking the aerodynamics of the tunnel had discovered that it would require air-conditioning: a big surprise for the tunnel designers. As a result, Eurotunnel is now buying what has been described as the world's most expensive air-cooling system. (p. 20)

**INCREMENTAL CDR:** Eurotunnel and TML are required to submit designs to the IGC for authorization. The original concession agreement contained merely a general outline of the plan. The additional submissions fill in the details. The IGC can reject any design on grounds of safety, security, environmental acceptability, and so on. In practice, under the pressure of time, the IGC received a number of design drafts during construction. This led to a series of piecemeal approvals on some elements of the project, which made ultimate rejection more difficult. (p. 16)

**COST ESCALATION:** Real construction cost estimates rose from around £2.3 billion in the 1985 submission, to £2.7 billion at the time of the Equity III prospectus in November 1987, to nearly £3 billion a year later. (p. 15)

**FINGER POINTING:** TML argued that the cost increases were chiefly due to deficiencies in the initial design and cost estimates. Eurotunnel maintained they were due to TML inefficiencies in following a perfectly satisfactory design. (p. 16)

**SCHEDULE PRESSURE (IMPENDING IOC):** An imbalance in the client-contractor relationship is generated by the fact that there comes a point in any large construction project when the cost of schedule overruns (in the form of lost revenues) is more damaging than direct cost increases. In other words, since Eurotunnel cannot earn a cent on its investment until the Tunnel is operational, it is apt to find schedule delays more damaging than cost overruns. This put a real weapon in the hands of the contractors. (p. 18)

**DE-SCOPING THE SPECIFICATION:** Arbitration between Eurotunnel and TML over cost disputes led to an agreement based on a lower Tunnel specification. Eurotunnel had to accept lower speeds through the

tunnel for trains and shuttles, open rather than closed truck-shuttles, a less glamorous Tunnel portal on the French side, and so on. (p. 19)

LATE EQUIPMENT DELIVERY, DELAYED CAPABILITY: In 1992, the company making the special, Chunnel versions of the French high-speed train for British Rail and SNCF announced that they would be a year late in delivery. Therefore Chunnel expresses will not be operating until summer 1994. In additon, the "Le Shuttle" wagons and their special engines, once promised for June 1993, are now six months behind in delivery. (p. 21)